The invention claimed is:

1. A supercapacitor, comprising:
   a substrate;
   a solid-state, electrode first film on the substrate;
   a solid-state, electrolyte second film on the first electrode film; and
   a solid-state, electrode second film on the electrolyte.

2. The supercapacitor of claim 1, wherein the working voltage is greater than 5 volts.

3. The supercapacitor of claim 1, wherein the electrolyte second film is less than about 5,000 Angstroms thick.

4. The supercapacitor of claim 1, wherein the electrolyte second film is less than about 1,000 Angstroms thick.

5. The supercapacitor of claim 1, wherein the electrolyte second film is less than about 500 Angstroms thick.

6. The supercapacitor of claim 1, wherein the electrolyte second film is less than about 250 Angstroms thick.

7. The supercapacitor of claim 1, wherein the electrode first film is a metal oxide.

8. The supercapacitor of claim 1, wherein the electrode first film is a RuO_2.

9. The supercapacitor of claim 1, wherein the electrode third film is a metal oxide.

10. The supercapacitor of claim 1, wherein the electrode third film is a RuO_2.

11. The supercapacitor of claim 1, wherein both the first film and the third film are formed of lithium intercalation material.

12. The supercapacitor of claim 1, wherein the first film and the third film each have a highly ordered crystal structure that provides superior energy charge/discharge rates and electrical energy density.

13. The supercapacitor of claim 1, wherein at least one of the first film and the second film include lattice planes that are essentially perpendicular to a boundary with the electrolyte second film.

14. The supercapacitor of claim 1, wherein the substrate has a thermal degradation temperature of less than 400 degrees Celsius.

15. The supercapacitor of claim 1, wherein the substrate has a thermal degradation temperature of less than 200 degrees Celsius.

16. The supercapacitor of claim 1, wherein the substrate has a thermal degradation temperature of less than 100 degrees Celsius.

17. The supercapacitor of claim 1, wherein the first film is a non-annealed electrode having a crystallite size of greater than about 240 Angstroms.

18. The supercapacitor of claim 17, wherein the first film is a non-annealed electrode film having a crystalline orientation with the lattice planes essentially perpendicular to a boundary between the non-annealed electrode film and the electrolyte film.

19. The supercapacitor of claim 1, wherein the third film has a crystallite size of greater than about 240Å.

20. The supercapacitor of claim 19, wherein the third film is an electrode film having a crystalline orientation with the lattice planes essentially perpendicular to a boundary between the electrode film and the electrolyte second film.

21. The supercapacitor of claim 1, wherein the electrolyte second film has an ordered structure that allows higher ion diffusion rates for enhancing the charge/discharge characteristics of the supercapacitor.

22. A method of fabricating a supercapacitor, comprising:

providing a substrate;

forming a solid-state first electrode film on the substrate;

forming a solid-state electrolyte second film on the first electrode film, including:

(a) depositing an electrolyte material to a location on the first electrode film, and

(b) supplying energized ions of a second material adjacent the location to control growth of a structure of the electrode material at the location; and

forming a solid-state second electrode third film.

23. The method of claim 22, wherein depositing the primary material includes depositing lithium phosphorus oxynitride as the primary material.

24. The method of 22, wherein forming the solid-state, first electrode film includes:

depositing an electrode material to a location on the substrate, and

supplying energized ions of a second material adjacent the location to control growth of a crystalline structure of the electrode material at the location.

25. The method of 24, wherein depositing the electrode material includes depositing a metal oxide.

26. The method of 24, wherein depositing the electrode material includes depositing RuO_2.

27. The method of 22, wherein forming the solid-state, electrode second film includes:

> depositing an electrode material to a location on the substrate, and supplying energized ions of a second material adjacent the location to control growth of a crystalline structure of the electrode material at the location.

28. The method of 27, wherein depositing the electrode material includes depositing a metal oxide.

29. The method of 27, wherein depositing the electrode material includes depositing RuO_2.

30. The method of claim 22, wherein supplying energized ions includes supplying ions having an energy within the range of about 5 to about 3000 eV.

31. The method of claim 30, wherein supplying energized ions includes supplying ions from a source gas including one or more of O_2 and N_2.

32. The method of claim 30, wherein supplying energized ions includes supplying ions from a source gas including one or more of argon, xenon, helium, neon, and krypton.

33. The method of claim 22, wherein supplying energized ions includes supplying ions having an energy within the range of about 5 to about 200 eV.

34. The method of claim 22, wherein supplying energized ions includes supplying ions having an energy within the range of about 10eV to about 500 eV.

35. The method of claim 22, wherein supplying energized ions includes supplying ions having an energy within the range of about 60eV to about 150eV.

36. The method of claim 22, wherein supplying energized ions includes supplying ions having an energy of about 140 eV.

37. The method of claim 22, wherein depositing the electrolyte second film includes using chemical vapor deposition to direct the primary material to the location on the substrate.

38. The method of claim 22, wherein supplying energized ions includes controlling stoichiometry of a growing electrolyte film.

39. The method of claim 22, wherein depositing the electrolyte film includes using physical vapor deposition to direct the electrolyte material to the location on the substrate.

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40. A method of fabricating a photovoltaic device, comprising:

providing a substrate;
forming an electrode first film on the substrate;
forming a semiconductor second film on the electrode first film;
forming a semiconductor third film on the semiconductor second film; and
forming an electrode fourth film on the semiconductor third, film
wherein one of forming the second film and forming the third film includes:

depositing semiconductor material using a deposition source; and
supplying energy to the semiconductor material to deposit the semiconductor material into a desired film structure.

Sub A1

41. The method of claim 40, wherein supplying energy includes supplying energized particles having energy of greater than about 5eV.

42. The method of claim 40, wherein supplying energy includes supplying energized particles having energy of less than about 3000eV.

43. The method of claim 40, wherein supplying energy includes supplying energized particles having energy in the range of about 5eV to about 500 eV.

44. The method of claim 40, wherein supplying energy includes supplying energized particles having energy in the range of about 5eV to about 250 eV.

45. The method of claim 40, wherein supplying energy includes supplying energized particles having energy in the range of about 10eV to about 200 eV.

46. The method of claim 40, wherein supplying energy includes supplying energized particles having energy in the range of about 20 eV to about 40 eV.

47. The method of claim 40, wherein forming the second film includes depositing CdS.

48. The method of claim 40, wherein forming the third film includes depositing CdTe.

49. The method of claim 40, wherein forming the second film includes the supplying energy, and wherein the supplying energy includes supplying ionized sulfur.

Sub A2

50. The method of claim 49, wherein forming the second film includes depositing the cadmium and reacting the cadmium with the ionized sulfur.

51. The method of claim 40, wherein forming the third film includes the supplying energy, and wherein the supplying energy includes supplying energized ions.

Sub A3

52. The method of claim 51, wherein forming the third film includes depositing the cadmium.

53. The method of claim 40, wherein supplying energy includes supplying ions simultaneously with depositing material from the deposition source.

54. The method of claim 40, wherein supplying energy includes supplying oxygen ions.

Sub B37

55. The method of claim 40, wherein supplying energy includes supplying a noble gas ions.

56. The method of claim 40, wherein the substrate is not heated during forming the second film or the third film.

57. The method of claim 40, wherein forming the semiconductor third film on the semiconductor second film includes depositing a high quality first region and then depositing a second highly doped region on the first region.

58. The method of claim 40, wherein the one of forming the second film and forming the third film includes providing energy to the semiconductor material being deposited by only means sending the semiconductor material toward the cell and by the means supplying energy.

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~~59. A~~ photovoltaic cell, comprising:

an essentially transparent substrate;

an essentially transparent ~~electrode first~~ film on the substrate

a semiconductor second film on the electrode first film;

a semiconductor third film on the semiconductor second film; and

an electrode fourth film on the semiconductor third film,

wherein the third film includes a high quality first region adjacent to the second film and a highly doped second region remote from the second film, and the first region and the second film form a pn junction of the photovoltaic cell.

60. The device of claim 59, wherein the second film has a thickness of about 50 nanometers to about 100 nanometers.

61. The device of claim 59, wherein the first region of the third film has a thickness of about 50 nanometers to about 100 nanometers.

62. The device of claim 61, wherein the second region of the third film has a thickness of greater than about 1000 nanometers.

63. The device of claim 59, wherein the high quality first region of the third film is formed by providing energized ions while material is deposited on the second film to grow the first region such that the first region has a reduced number of defects.

64. The device of claim 63, wherein the first region of the third film has large crystal sizes.

65. The device of claim 64, wherein the first region includes P-doped CdTe.

66. The device of claim 59, wherein the substrate, first film, second film third film, and fourth film provide an efficiency of greater than about 10 percent.

67. The device of claim 59, wherein at least one of the substrate, the first film and the fourth film have a thermal degradation temperature of less than about 500 degrees Celsius.

68. A system for fabricating photovoltaic cells, comprising:

chamber in which a substrate on which the cell is to be formed,

deposition apparatus connected to the chamber, the deposition apparatus directing material to be deposited toward the substrate, and

means for providing energy to the material while the material is forming a film on the substrate.

69. The system of claim 68, wherein the means for providing energy includes a directed energy source that does not appreciable heat the substrate.

70. The system of claim 68, wherein the chamber has a temperature of less than about 300 degrees Celsius.

71. The system of claim 68, wherein the chamber has a temperature of less than about 250 degrees Celsius.

72. The system of claim 68, wherein the chamber is adapted to hold the substrate below about 500 degrees Celsius.

73. The system of claim 68, wherein the chamber is adapted to hold the substrate below about 300 degrees Celsius.

74. The system of claim 68, wherein the chamber is adapted to hold the substrate below about 200 degrees Celsius.

75. A system for fabricating photovoltaic cells, comprising:

a chamber in which a substrate on which the cell is to be formed,

a deposition apparatus connected to the chamber, the deposition apparatus directing material to be deposited toward the substrate, and

~~an energy source directing energy to the material while the material is forming a film on the substrate.~~

~~76. The system of claim 75, wherein the energy source is an ion beam source.~~

~~77. The system of claim 76, wherein the ion beam source produces energized ions having energy of about 3eV to about 3,000eV~~

add A4

add B45